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The practical photographer speaks to-day of loading the molecules by putting various gums into emulsions in order to make the molecules vibrate slower. This metaphorical expression is extremely suggestive, and opens to the imagination the immense field in which Dr. Draper was a master. Photography has already shown us the solar spectrum far beyond the limits of the visible red, and it is said that, had Dr. Draper lived even through the brief space of a twelvemonth longer, he would have succeeded in photographing stars which could not be detected, through the telescope he was using, by the eye.

## GEORGE PERKINS MARSH.

GEORGE PERKINS MARSH was born at Woodstock, in the State of Vermont, on the 15th of March, 1801. He was elected an Associate Fellow in Class III., Section 2, of the Academy, on the 29th of January, 1851. He died at Vallombrosa, in Italy, on the 24th of July, 1882, closing peacefully a long career of great and unceasing usefulness in the service of the republic and of learning.

We cannot wonder that the death of a man so pure, so kindly, so noble and earnest in purpose, and so strong in deed, should call forth, as it does, the reverent and loving sorrow of two nations that he loved perhaps equally, and which he had successfully striven to bring into relations of serviceable friendship during the years in which he represented the one at the court of the other. This republic has lost a loyal, watchful, wise, and able servant, who has caused its name to be honored and loved, not only by reason of his eminent diplomatic services during twenty-five years, but also by the power of his personal worth. United Italy grieves as for a foster-father, who brought to the help of its trembling infancy the strong sympathy of a sturdy republic in the vigor of its early prime. Perhaps it will never be fully known how greatly this noble man strengthened the hands of both the kings of new Italy, as they struggled to break away from the chains of priestcraft and the relics of feudalism into the freedom of self-government.

How high a rank our late Associate held as a student and expounder of truth in the fields of natural science, of philosophy, of political economy, of archæology, of philology, and of literature, is attested by the many learned societies, both in this and in other countries, that deemed it an increase of honor to themselves to write his name in their lists of members.

What Mr. Marsh was as a friend and counsellor is happily known

to many whom his generous heart embraced in those intimate relations. How dear he must have been to those who stood within the circle of his family, they alone can know. We feel that their loss is unspeakable, and we can only draw near to their sacred sorrow with our best offerings of earnest sympathy for them, and of profound reverence and admiration for him.

Such is the man whose name death has struck from our roll. We look with desire for a full account of his life from some hand competent to the grateful task. In such a memoir we shall hope to find a just estimate of Mr. Marsh's public services to his native State and to the Republic, both at home and abroad, and also of his scientific and literary work. In the mean while a short outline of his life may fitly be put on record here, together with a brief account of his published writings.

George Perkins Marsh was graduated a Bachelor of Arts by Dartmouth College in the class of 1820. He also received from his College the Master's degree in course. Harvard College and Delaware College honored him with the degree of Doctor of Laws in 1859, and Dartmouth College did the same in 1860. He was, at the time of his death, a member of this Academy, of the Massachusetts Historical Society, and of the American Philosophical Society, not to speak of others in this country, and of many foreign societies.

Having taken his first college degree, Mr. Marsh established himself at Burlington, Vermont, where he read and practised law. In 1835 he served in the legislature of Vermont, and he represented that State in Congress from 1842 to 1849. In the latter year he was commissioned by President Taylor as Minister Resident of the United States at Constantinople. He remained at that post until 1853. In 1852 the United States intrusted him with a special mission of peculiar delicacy to the King of Greece, "to adjust the difficulties that had sprung up between the Greek government and the Rev. Jonas King, acting Vice-Consul of the United States." The profound knowledge of the principles of international law, as well as of the Greek constitutional law, which Mr. Marsh displayed in his masterly conduct of these negotiations, appears to have made a strong impression of his learning and skill among European statesmen. At the close of his residence at Constantinople, Mr. Marsh returned to America, where his executive ability and scientific acquirements were at once enlisted in various public services by his native State. The years between 1853 and 1861 were spent by Mr. Marsh in these services, and in preparing and publishing several philological and scientific works, and in delivering

lectures in Washington, New York, and Boston. In 1861 President Lincoln accredited Mr. Marsh as Envoy Extraordinary and Minister Plenipotentiary of the United States at the Court of Italy. He continued to hold this honorable office until he died.

Besides numerous minor writings, including his contributions to periodical publications, and besides any writings which his literary executors may yet bring to light, Mr. Marsh left several larger published works which may conveniently be arranged in two classes.

To the first class belong the two works entitled, respectively, "The Earth as Modified by Human Action," and "The Camel, his Organization, Habits, and Uses, considered with Reference to his Introduction into the United States." The former of these books is a corrected and enlarged edition of an earlier work of the same author, entitled "Man and Nature, or Physical Geography as modified by Human Action."

This book, upon which Mr. Marsh's reputation could well afford to rest, is, like his other works, characterized by thoroughness, earnestness and practical good sense. It does not profess to be a scientific work, but to address itself to the common sense of men of average intelligence, for purposes merely practical.

The work is so complex in its structure, and so full of details as heterogeneous as they are important, that it can only be analyzed in the most general terms. Its general scope is to exhibit the exceptional position of man, as distinguished from all other living organisms, in respect to the power of influencing the aspect and the operations of Nature; and to inculcate the wisdom and the duty of directing this power according to the dictates of sound reason and the teachings of experience, so as not only to reach the best results and avoid former errors, but also to remedy, so far as is still possible, the evil already caused by inexperience and want of caution.

Man, who in his savage state is a mere consumer of what Nature has provided, soon becomes a producer, using to that end, and modifying to a remarkable extent, the powers of Nature of which he has learned the secret more or less completely. That he shall learn it most thoroughly so far as such knowledge is permitted to him, and that he shall use due caution in his interference with Nature's spontaneous operations, is the author's wise endeavor.

Mr. Marsh approached the work in his wonted spirit of earnestness, and with that faithful preparation which he brought to all that he attempted. The works which he consulted are more than three hundred in number, and are written in a dozen languages. To give credit in

detail to each author for what he has found useful in his works would have encumbered the book with an intolerable bulk of references. The author has wisely avoided doing so whenever the matter did not seem to require, by its novelty or strangeness, the support of some recognized authority. In these cases the statement is generally given in the words and with the name of the writer who is responsible for it.

The book has three principal divisions. First, an introductory chapter exhibits the character, extent, and variety of man's action on Nature. Next, four chapters treat in detail of man's influence upon animal and vegetable life, the forest, the waters, and the sands. Finally, a most suggestive and useful chapter deals with the great projects which this century has brought forth for the modification of the physical character of our globe.

Under the first of these heads we are shown how some of the most flourishing provinces of the Roman Empire have been brought to a condition of hopeless decay by neglect of those terms which Nature imposes upon those to whom she permits such wonderful control over her own operations. Man, who could not exist in a civilized state without in a measure unbalancing Nature's stable equilibrium, has persistently exceeded that measure. His action has, on the whole, been destructive, although in some places and in recent times there is a reverse to this melancholy picture. There are regions first peopled by Europeans not more than two hundred years ago which already show signs of dilapidation.

The author then enters upon a detailed description of man's interference with Nature in respect to animal and vegetable life, showing how he promotes the growth of certain species of plants and animals often changing their nature in a wonderful degree by his care and cultivation, — how he greatly reduces the numbers of other animals and plants, often altogether expelling certain animals from particular regions, and sometimes, though rarely, effecting, or at any rate greatly hastening, the annihilation of certain species. Mr. Marsh illustrates the matter by copious examples culled from his prodigious and encyclopedic reading. It would be hopeless to attempt to give any adequate idea of their variety and interest. Few men indeed are so minutely acquainted with historical botany and zoölogy, and with the practical side of natural history, as not to find in these pages a rich harvest of the most interesting and instructive details.

No less remarkable is the author's chapter on forests, their position in the economy of Nature, their influence on climate, on torrents and inundations, on health, and the importance of man's operations involving their destruction or conservation.

Waters and their management are treated with the same mastery of details. It is shown how, by man's various devices for obstructing, directing, and in general governing water, the action of tides and the fauna and flora of regions may be altogether changed, whether beneficially or injuriously.

Even dry sands are invested with an interest not their own. The value of dunes, and the details of their wise management, are made the subject of one of the most interesting chapters of this most interesting book.

But the part of the work which will perhaps most engage the attention of the general reader is the concluding chapter, in which Mr. Marsh has examined by the light of wisdom and experience all the great projects proposed within the last quarter of a century for the extensive modification of the face of Nature. In this chapter he discusses such vast subjects as the cutting of isthmuses like Suez and Darien, the proposed canal to open the Dead Sea, the Caspian and Azof Canal, the flooding of the Lybian Desert, and the diversion of the Colorado River for the reclaiming of the great Colorado Desert, and incidentally discusses such living questions as the damage caused by hydraulic mining, and even the extent to which volcanic action may be subject to man's control. And lest the consideration of such immense results of man's action should blind the reader to the equal importance of little agencies repeatedly brought into action, the author concludes his work with this eminently philosophical remark. "In the vocabulary of Nature," says he, "little and great are terms of comparison only; she knows no trifles, and her laws are as inflexible in dealing with an atom as with a continent or a planet."

This last remark is but one of many keen and clever bits of philosophy with which the work abounds. Mr. Marsh keeps ever in view the peculiar needs and dangers of the two nations that shared his best affections, America and Italy, and he is abundant in practical suggestions for both countries. His views of history are large and clear, especially in regard to the influence of education and of civil and religious liberty. The man's generous nature appears in this, as well as in the frank tribute which he willingly pays to Elisée Reclus, his only rival in this branch of literature.

Mr. Marsh's style is always clear and direct. In his choice of words he is not rigidly a purist. When such words as "degradation," meaning the wearing away of the surface of a hill-side, or the like, or "flotation," come handy, he uses them without apology. Even the American words "lumber" and "lumberman" he does not disdain.

In a work of this nature mere diction is, of course, a secondary matter ; yet the reader occasionally meets with some concise sentence which reveals remarkable epigrammatic force, and a passage here and there full of poetic beauty.

And if the reader would know how a man occupied in the varied labors of a life like Mr. Marsh's could find the time or the will to produce a work like this, he will find his answer in the author's admirable disquisition, on pages 11-14 of this book, upon the duty and profit of learning to see. "Sight," says he, "is a faculty ; seeing, an art. To the natural philosopher, the descriptive poet, the painter, the sculptor, and indeed every earnest observer, the power most important to cultivate, and at the same time hardest to acquire, is that of seeing what is before him." This power Mr. Marsh had acquired to a high degree, and had so well used it to fill his memory with an infinite variety of useful facts that their expression, when digested in the alembic of his judicious mind, must have been to him as much a delight and a necessity as to another it would have been a labor and a weariness ; for from the abundance of the heart the mouth speaketh.

The monograph on the Camel belongs to the period in which Mr. Marsh was Minister of the United States at Constantinople. "The practicability and expediency of introducing the camel into the United States" had engaged his attention "as a problem of much economical interest," even before he went to Turkey. In that country he was able to investigate the subject yet more fully. He also turned to good account several months of travel in Egypt, Nubia, Arabia Petræa, and Syria, and he likewise saw the camel at work in Constantinople and at different points in Asia Minor. Besides these personal observations, he gathered such information as he could by inquiry and correspondence, and by consulting the books of travel and natural history to which he had access. "By these means," he says in his Preface, "I arrived at a strong persuasion of the probable success of a judiciously conducted attempt to naturalize in the New World this oldest of domestic quadrupeds, and at the same time I collected most of the materials which compose the following pages." After his return to America he added to his previous sources of information the valuable treatises of Ritter, Carbuccia, and others.

Before Mr. Marsh's treatise was printed, he had delivered a lecture covering some of the same ground before the Smithsonian Institution, which incorporated it in one of its Reports. The occasion for publishing the book appears to have been given by the discussions in Congress on the question of "importing camels for army transportation and for

other military purposes," which culminated in an appropriation of money to this end.

Mr. Marsh's handling of this subject shows the spirit in which he studied all subjects. His work never was that of a dilettante. By original investigations he would form clear and strong convictions, which he would then carefully compare with the opinions of other observers, never failing to reach substantial practical conclusions. Of this treatise on the Camel he says, "I claim no merit but that of fidelity in presenting the conclusions at which I have arrived." "I have intended," he adds, "to take a purely practical view of my subject, and I have, therefore, sought to condense into the limits I have prescribed to myself the greatest possible amount of information, and to fortify my statements by the most reliable authorities." A rapid survey of this book will show how well the author carried out his purpose.

In a brief introductory chapter he reminds us that the Creator commanded man to subdue the earth, and invested him with dominion over all terrestrial creatures. Man has, as yet, fulfilled but a part of this proud destiny. Of all the *vegetable* and *animal* products of the globe at least, comparatively few have been subdued to human use, still fewer permanently domesticated in our fields and our households. The proper *savage* only asks of *inorganic* Nature the gifts which she spontaneously offers him. But even in the very dawn of social life, man demands of the *organic* world, not merely the usufruct of its spontaneous productions, but the complete appropriation and domestication of many species of both plants and animals. We accordingly owe to our primeval, untutored ancestors the discovery, the domestication, and the acclimatization of our cereal grains, our edible roots, and our improved fruits, as well as the subjugation of our domestic animals, while *civilized* man has directed his efforts under the Creator's commission almost exclusively to the conquest of the *inorganic* creation, and has scarcely reclaimed a plant of spontaneous growth, or added a newly tamed animal to the flocks and herds of the pastoral ages.

Many of the domesticated families of the organic world are peculiarly suited to the uses of man as a migratory animal, and are apparently almost exempted from subjection to climatic laws, and accordingly follow him in all his wanderings. Others seem to be inexorably confined within prescribed geographical bounds. Others, again, though comparatively independent of climate and of soil, are nevertheless specially fitted to certain conditions of surface, and to certain modes of human life, to the maintenance of which they are themselves indispensable.



In the second chapter Mr. Marsh goes on to show that the camel belongs to the last-mentioned class of domesticated animals. Nature has adapted this quadruped chiefly to the desert, where he acquires his true significance and value, his remarkable powers being the necessary condition and sole means by which man has in any degree extended his dominion over the Libyan and the Arabian wildernesses, for example. But as society advances in refinement, the camel gives place to animals better suited to the wants and caprices of higher civilization. Even the enclosing of land for agricultural uses, and the superseding of the coarse herbage of spontaneous growth by artificial vegetation, are unfavorable to his full development and physical perfection. Hence the attempts to introduce the camel into Spain, Italy, and other European countries have met with at best a very indifferent success.

Mr. Marsh next examines the several species and breeds of the camel, in a series of learned chapters on the general and special anatomy of this animal, treating in detail of the hump, the head, the foot (adapted as well to the yielding sands as to the rugged rocks), and of the complicated structure of the stomach. Then follows a chapter on the size, color, diseases, temper, and longevity of the animal; after which the useful products of the camel, and his diet and powers of abstinence, are examined. His training and treatment form the next division of the subject. The author here gives us, upon the best authorities, an astonishing estimate of the great carrying power of the camel, and shows us the proper mode of saddling him for this service. Precise statements follow of the camel's speed and gait. Then, after having relieved the severity of his discussion by quoting from another writer an interesting and instructive passage on the characteristic pleasures and pains of travel by camel caravan, and after an allusion to the almost incredibly great number of camels employed in Egypt and other Mussulman countries, Mr. Marsh goes on to discuss the "geographical range" of the several species. One species is found in perfection in some of the hottest countries on the globe. Another bears with impunity the severities of Northern winters. The geographical range of the camel has been greatly extended even in comparatively recent times, and Mr. Marsh confidently expected that this animal would be naturalized in yet other regions, including New Mexico and California.

Having thus fully established the great value of the camel as a helper in man's work, the author answers affirmatively the ultimate question whether any large tracts of our territory possess the climate

and soil best fitted to the animal's usefulness. He shows that our Trans-Mississippian regions, and our Southwestern territories, including the southern passes of the Rocky Mountains, possess all the requisite conditions. In the closing chapter he traces the use of the camel for military purposes from the earliest historical times to the present, and sets forth the expediency of employing the animal in these services in the United States, especially against our hostile Indian tribes.

Mr. Marsh had the satisfaction of seeing the introduction of the camel tried by our government with so much wisdom and skill as to elicit his warmest praise of all those who had a share in the experiment. He forgets, however, to claim any praise for his own distinguished services in the matter.

The book has an index, which places its valuable contents readily at the reader's command.

While the books that have just been analyzed may be called scientific, those of the second group belong to the provinces of philology, literary history, and archæology. The largest of Mr. Marsh's works in these departments are the courses of lectures delivered by him, in New York and Boston respectively, upon the English Language. The first of these was given at Columbia College in the years 1858-59, and published under the name of "Lectures on the English Language"; the second was delivered at the Lowell Institute in 1860-61, and issued with the title of "Origin and History of the English Language, and of the early Literature it embodies." Another of his philological works is the admirable enlarged edition of Wedgwood's Dictionary of English Etymology.

Mr. Marsh's attainments in the Scandinavian languages and lore were early recognized and honored by the learned societies of Northern Europe. One fruit of his studies in that direction was a Grammar of the Icelandic Language, compiled from the several works of Rask, the Danish philologist.

The antiquarian researches of Mr. Marsh are represented by the careful study that he made of the position and influence of the Goths in history, even tracing the Gothic element in the Puritans of New England.

The two groups into which we have ventured to divide Mr. Marsh's writings combine their forces to prove how vast and exact was his learning, and how thorough and judicious were his methods of intellectual work. But it is the first group that specially exhibits his individual characteristics. There we see him pursuing a wholly new inquiry,

and again conducting triumphantly the investigation of a subject so abstruse, so vast, and so complex, that it is fair to say he had no rival in the work. These two books of his must long remain the classics in their respective provinces. It is for these reasons that an analysis of them has been attempted here. In the second class of subjects, on the other hand, Mr. Marsh was one of many laborers. The study of language, in its several divisions, has been many years enlisting a larger and larger number of able scholars. Moreover, in the rapid progress of modern philology, any man's labors, be they never so eminent, may soon be superseded, wholly or in part. We are very far, however, from intimating that any such destiny has overtaken Mr. Marsh's philological or literary works. They will ever be store-houses of precious materials; and they are now, in their latest revisions, so fully abreast of the most recent discoveries, that no earnest student of English philology can afford to neglect them, or is in danger of doing so. All these considerations render it inexpedient to essay here the analysis of any book of Mr. Marsh's in this department; nor, indeed, could any fair analysis be made that should not transgress the reasonable limits of a notice like this.

An account of Mr. Marsh and his work would fall far short of completeness, even in form, without some allusion to his remarkable library. No monument can be reared to the memory of a man of letters more fitting than the one he has reared for himself in the collection of books that he gathered about him as the instruments and helpers of his daily tasks. The scholar's loves and purposes are embodied in his library as truly as in his published work; often, perhaps, even more fully.

This library is described as containing twelve thousand volumes, some miscellaneous and modern, "many rare, valuable, ancient, and curious." The languages of Northern and Central Europe are, of course, largely represented; those of Southern Europe probably no less so. For Mr. Marsh's attention had been fixed, for several years before his death, on the revival, which is even now in progress, of the noble Catalan dialect and of the Provençal, and his intimate study of the Italian language had led him, long before, into the less frequented paths of its literature. One of his cherished plans had been that of a complete English-Italian Dictionary which should adequately register the "grammatical relations" of the words in each language, and should be worthy of both. As he felt his own strength declining, he often tried to persuade younger students to engage in this work.

By the liberality of an alumnus of the University of Vermont, of which Mr. Marsh was for a time one of the Trustees, this precious collection of books has been secured for that institution. It is to be regretted that these literary treasures were not deposited where the largest numbers congregate of those who would turn them to good account. Yet, while we deplore the limitation of its usefulness, we cannot but be glad that Mr. Marsh's library, unlike that of the late Mr. Benfey and other valuable collections, has found a large-minded and large-hearted man who would not allow its collective force to be destroyed.

## ISAAC RAY.

ISAAC RAY, M. D., LL. D., was born at Beverly, Mass., January 16, 1807, and died in Philadelphia, March 31, 1881.

Dr. Ray graduated from Phillips Academy and Bowdoin College, teaching school during vacations in order to help defray his expenses. He took his degree of Doctor of Medicine at the Harvard Medical School in 1827, and at once began practice in Portland, Maine, where he was married in 1831. Soon after, removing to Eastport in the same State, he published (in 1838) his "Medical Jurisprudence of Insanity," a book of which the sixth edition has recently appeared, and which has remained for more than forty years the leading work in the English language upon that subject.

Dr. Ray was Medical Superintendent of the State Hospital for the Insane at Augusta, Maine, from 1841 to 1846. He was then appointed to take charge of the building of the Butler Hospital for the Insane at Providence, R. I., of which he was the head for twenty years after its completion. He was also for a few months in charge of the McLean Asylum at Somerville, Mass., but failing health compelled him to seek a milder climate, and the last fourteen years of his life were spent in Philadelphia, very much saddened toward the end by the death of his only surviving child, a son, practising medicine, and having his office in his father's house. Dr. Ray was one of the organizers of the Association of Medical Superintendents of American Institutions for the Insane, in 1844, and was its President from 1855 to 1859. He was a most careful student, having visited Europe to examine the hospitals there, and a most assiduous writer upon the various subjects of interest in his branch of the medical profession. His "Mental Hygiene," a series of lectures delivered before the Lowell Institute in Boston, published in 1863, and his "Contributions to Mental Pathol-